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Student Training Manual for

CYBER FMD SERIAL APPLICATION



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This manual contains all necessary Student Materials for the subject course and is to be retained by the student.

The following sections will normally be included in this manual. However, if they are not included, it is because they have not been developed at this time.

- Course and Learning Objectives - The Course Objectives identify student performance, and the Learning Objectives identify the steps needed to accomplish the Course Objectives.
 - Course Chart - This is a layout of the course on a daily basis, and can be used by the student in planning his time in the course.
- Handouts - These are normally drawings that are used for clarification or to provide supplementary information.
- Workbook - This is assigned by the instructor either as homework or work to be done in the lab while waiting for machine time. The workbook is not assigned as "Busy Work," but is an integral part of the course.
 - Student Lab Manual - This is used by the student as a guide in the lab. There may be projects to perform, questions to answer or reading assignments to complete, and like the workbook this is another important element of the course and should be completed in a timely manner.

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OBJECTIVES

O-1

COURSE CHART

CC-1

HANDOUTS

HO-i/TR-i thru HO-23/TR-23

STUDENT LAB MANUAL

SLM-1 thru SLM-70

CYBER FMD Serial Application Student Manual Objectives

- I.U.1 You will be able to identify all specified areas of the BZ703 and FA211-A/B manuals.
- I.U.2 You will be able to describe the access levels and device codes used by the FMD subsystem diagnostics and the Utility Program FMU.
- I.U.3 You will be able to describe the hierarchy and purpose of the FMD subsystem diagnostics and the Utility program FMU.
- I.U.4 You will be able to describe the purpose of the Parameters, Modules, and Messages of the FMD subsystem diagnostics and the Utility program FMU.
- I.U.5 You will be able to use the appropriate section of the 7155 Troubleshooting Guide for Equipment, Controller, and Drive isolation.
- I.U.6 You will be able to use the procedures in the 7155 Troubleshooting Guide to deadstart the computer and load controlware.
- I.U.7 You will be able to analyze general and detailed Status Reports for 7155 subsystem failures.
- I.U.8 You will be able to use procedures in the 7155 Troubleshooting Guide to load, run, and interpret the FMD subsystem diagnostics and the Utility FMU on-line from a remote terminal and a system console.
- I.U.9 You will be able to use procedures in the 7155 Troubleshooting Guide to load, run, and interpret the FMD subsystem diagnostics and the Utility FMU off-line from the system console.
- I.U.10 You will be able to use procedures in the 7155 Troubleshooting Guide to manipulate the operating system to allow running FMD subsystem diagnostics on failing FMD equipment.
- I.U.11 You will be able to isolate, repair, and verify a FMD subsystem failure to a drive or controller Field Repairable Unit (FRU).
- I.U.12 You will be able to isolate a FMD subsystem failure to a drive or controller non Field Repairable Unit (FRU).

CYBER FMD SERIAL APPLICATION

	DAY 1	DAY 2	DAY 3	DAY	DAY
1	Introduction	Lab Diagnostics and Trouble- shooting	Lab Diagnostics and Trouble- shooting		
2	Serial FMD Diagnostics				
3	7155 Trouble- shooting Guide				
4	Lab Diagnostics				
5					
6					
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CYBER FMD SERIAL APPLICATION
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HO-i/TR-i

SERIAL FMD SUBSYSTEM DIAGNOSTICS

D88 —————→ 885/7155 SUBSYSTEM CONFIDENCE TEST

FMC —————→ 7155 CONTROLLER DETECTION AND ISOLATION DIAGNOSTIC

FMD —————→ 885 DRIVE DETECTION AND ISOLATION DIAGNOSTIC

D44 —————→ 844/7155 (7X54) SUBSYSTEM CONFIDENCE TEST

DTC —————→ 844 DRIVE TEST

FMU —————→ UTILITY PROGRAM FOR 885 AND
844 DISK DRIVES ON 7155 CONTROLLER

SERIAL FMD SUBSYSTEM—PACK LAYOUT

MANUFACTURING DATA

CYL	TRACK	SECTOR
844-4X = 822	0	0
885-1X = 841	0	0

FACTORY MAP

844-4X = 822	0	1
885-1X = 841	0	1 = DEF. TRACKS, 2-18 = DEF. SECTOR

UTILITY MAP

844-4X = 822	0	2
885-1X = 841	1	0-18

DEAD START SECTOR

844-4X = 822	0	3
885-1X = 841	1	30

CONTROLWARE SECTORS

844-4X = 822	1,2	0-23, 0-5
885-1X = 841	2	1-30

DISK ACCESS LEVELS

1=READ PRE-ALLOCATED AREA.

2=READ ANY NORMAL DATA AREA ONLY.

3=READ ANY NORMAL DATA AREA, WRITE PRE-ALLOCATED AREA ONLY.

4=READ/WRITE ANY NORMAL DATA AREA.

10=DEDICATED CONTROLLER AND ALL UNITS.

20=DEDICATED CONTROLLER, ALL UNITS, AND CHANNELS.

21=SAME AS 20, PLUS CHANNEL MAY BE LEFT IN HUNG STATE.

DEVICE CODES FOR 7155 SUBSYSTEM

05=844-4X DISK

07=885-1X DISK

14=885-42 DISK (DEMA)

D88 - FMD SUBSYSTEM CONFIDENCE TEST

D88 IS A CONFIDENCE TEST FOR THE 7155 DISK SUBSYSTEM. THE TEST IS DIVIDED INTO THREE PARTS, THE CONFIDENCE/VERIFICATION MODULES (D8801-D8839), THE PARAMETER DRIVEN MODULES (D8840-D8846), AND THE REPAIR MODULES (D8860-D8865).

THE CONFIDENCE/VERIFICATION MODULES ARE DESIGNED TO RUN WITHIN TWO MINUTES AND PROVIDE THE USER WITH A HIGH DEGREE OF CONFIDENCE THAT THE 7155 DISK SUBSYSTEM IS OPERATIONAL. THESE MODULES DO NOT REQUIRE ANY PARAMETERS TO RUN.

- D8801 RESERVE CONTROLLER -
TEST THE COMMUNICATION PATHS BETWEEN THE FMD
CONTROLLER AND THE CYBER 170/70 PP CHANNEL. AL=1.

- D8803 ZERO WORD AUTOLOAD TEST -
TEST THE RESET OPERATION. AL=1.

- D8805 GENERAL STATUS TEST -
TEST FOR INTERMITTENT FAILURES IN THE DATA PATH
BETWEEN THE PP AND THE FMD CONTROLLER BY READING
GENERAL STATUS. AL=1.

- D8807 DETAILED STATUS TEST -
TEST FOR INTERMITTENT FAILURES IN THE DATA PATH
BETWEEN THE PP AND THE FMD CONTROLLER BY READING
DETAILED STATUS. AL=1.

- DD8809 DIAGNOSTIC WRT/RD TEST -
TEST THAT THE CYBER CHANNEL (CHANNEL 16) WILL TRANSFER
DATA TO AND FROM THE FMD CONTROLLER BUFFER. AL=1.

- D8811 READ COUPLER BUFFER -
TEST THAT THE NORMAL CHANNELS ARE CAPABLE OF READING
DATA FROM THE FMD CONTROLLER BUFFER. THE 885 DRIVE IS
NOT ACCESSED IN THIS MODULE. AL=1.

- D8812 DRIVE BUS OUT TEST -
TEST THE BUS OUT DATA PATH TO AND BUS IN DATA PATH
FROM THE 885 DRIVE. AL=1.

- D8813 SEEK TIME MEASUREMENT -
MEASURE THE 885 SEEK TIME BY TIMING THE 885 SERVO
USING A CONTROLWARE FUNCTION. AL=1.

- D8815 READ FLAW MAPS -
DETERMINE IF THE SERIAL NUMBER, THE FACTORY FLAW MAP
AND UTILITY FLAW MAP CAN BE READ OFF THE PRE-RECORDED
SECTORS OF A FACTORY FORMATTED PACK. AL=3.

HO-5/TR-5

D88 - FMD SUBSYSTEM CONFIDENCE TEST (Cont'd)

D8817 READ PREWRITTEN SECTOR -
 VERIFY THAT THE HEAD POSITIONING IS THE SAME AS WHEN
 THESE SECTORS WERE WRITTEN BY THE FMU UTILITY. AL=3.

D8819 WRITE/DIAGNOSTIC READ -
 VERIFY THAT NORMAL CHANNELS (CHAN. 0-15) CAN WRITE
 DATA TO THE FMD CONTROLLER BUFFER. AL=3.

D8821 WRITE PREALLOC. CYL
 WRITE ADDRESS CODED INFORMATION IN 1/1 INTERLACE MODE
 IN ALL SECTORS OF CYLINDER 1512 TO INSURE THAT THE
 DATA WAS RECORDED ON THE SURFACE WHERE EXPECTED. AL=3.

D8823 READ PREALLOC. CYL -
 DATA PREVIOUSLY WRITTEN BY MODULE D8821 WILL BE READ
 AND VERIFIED AT 2/1 INTERLACE MODE.. AL=3.

D8825 COR. VECTOR LOGIC TEST -
 VERIFY THAT THE HARDWARE CAN SUCCESSFULLY CORRECT UP
 TO 8 BITS OF BAD DATA BUT CANNOT CORRECT MORE THAN 8
 BITS OF BAD DATA. AL=3.

D8827 W/VERIFY PREALLOC. CYL -
 TO WRITE AND WRITE VERIFY CYLINDER 1512 IN 2/1
 INTERLACE IN CYLINDER MODE TO VERIFY THAT THE WRITE
 VERIFY PERFORMS CORRECTLY. AL=3.

D8829 FORCE W/VERIFY ERROR -
 VERIFY THAT A WRITE VERIFY FAILURE CAN BE DETECTED BY
 THE CONTROLLER. AL=3.

D8831 READ CHECKWORD -
 VERIFY THE ABILITY OF THE CONTROLWARE AND CONTROLLER
 TO PERFORM A READ CHECKWORD SEQUENCE. AL=2.

D8833 RANDOM SEEK -
 PERFORM A SEEK TO A RANDOM CYLINDER AND THEN SEEK TO
 THE INNERMOST CYLINDER. REPEAT THIS SEQUENCE TWO
 TIMES, EACH TIME VERIFYING THE SEEK ADDRESS BY USING
 THE RETURN ADDRESS FUNCTION. THIS SEQUENCE IS
 REPEATED 25 TIMES USING 25 RANDOM CYLINDER ADDRESSES.
 AL=3.

D8835 WRITE CODED CYLINDER -
 WRITE CYLINDER 1512 WITH CODED DATA AND A UNIQUE DATA
 PATTERN IN EACH SECTOR IN 1/1 INTERLACE MODE TO CREATE
 A WORST CASE CONDITION IN THE CYLINDER. AL=3.

D88 - FMD SUBSYSTEM CONFIDENCE TEST (Cont'd)

D8837 READ/VERIFY C-CYLINDER -
 VERIFY THAT THE ADDRESS CODING WAS CORRECTLY WRITTEN
 BY THE PREVIOUS MODULE (D8835) USING INTERLACE 2/1
 MODE. AL=3.

D8839 WRT CURRENT SWITCH TST -
 VERIFY THE CORRECT SWITCH POINTS IN THE 885 DRIVE BY
 DOING A READ CHECKWORD ON EVEN AND ODD HEADS AT
 CYLINDERS 0, 512D, 513D, and 842D. AL=1.

THE PARAMETER DRIVEN MODULES ALLOW THE OPERATOR TO WRITE AND/OR READ
ANYWHERE ON THE 885 DISK. THESE MODULES USE PARAMATER WORDS P1 THRU
P9 TO CONTROL TESTING OF THE 885 DRIVE. CAUTION SHOULD BE USED WHEN
RUNNING THESE MODULES BECAUSE CUSTOMER DATA COULD BE DESTROYED.

D8840 SEQUENTIAL WRITE/READ TEST -
 WRITE AND READ EACH TRACK SELECTED ON THE 885 DRIVE IN
 A 2 TO 1 INTERLACE MODE. AL=4.

D8841 SEQUENTIAL WRITE/READ COMPARE TEST -
 WRITE, READ AND COMPARE THE DATA READ FROM THE TRACK
 FOR EACH TRACK SELECTED ON THE 885 DRIVE IN A 2 to 1
 INTERLACE MODE. AL=4.

D8842 SEQUENTIAL WRITE/READ TEST -
 WRITE AND READ EACH TRACK SELECTED ON THE 885 DRIVE IN
 A 1 TO 1 INTERLACE MODE. AL=4.

D8843 SEQUENTIAL WRITE/READ COMPARE TEST -
 WRITE, READ AND COMPARE THE DATA READ FROM THE TRACK
 FOR EACH TRACK SELECTED ON THE 885 DRIVE IN A 1 TO 1
 INTERLACE MODE. AL=4.

D8844 SEQUENTIAL WRITE/READ TEST -
 WRITE AND READ EACH CYLINDER SELECTED ON THE 885 DRIVE
 IN A 1 TO 1 INTERLACE MODE. AL=4.

D8845 RANDOM WRITE/READ TEST-
 DO WRITES AND READS USING RANDOM CYLINDER NUMBERS,
 RANDOM TRACK NUMBERS, RANDOM SECTOR NUMBERS, AND A
 RANDOM NUMBER OF SECTORS IN A 1 TO 1 INTERLACE MODE.
 AL=4.

D8846 SWEEP HDA CHECKWORDS -
 DO A READ CHECKWORD IN A 1 TO 1 INTERLACE TRACK MODE
 ON THE CYLINDERS, TRACKS, AND SECTORS SELECTED IN THE
 PARAMETERS TO VERIFY THAT THE HEAD DISK ASSEMBLY CAN
 BE READ. AL=2.

HO-7/TR-7

D88 - FMD SUBSYSTEM CONFIDENCE TEST (Cont'd)

THE REPAIR MODULES ARE DESIGNED TO AID THE USER BY LOOPING ON A SPECIFIC FAILURE. THE USER CAN THEN USE A SCOPE TO FIND THE CAUSE OF THE FAILURE AND CORRECT THE PROBLEM. SOME OF THE MODULES USE THE PARAMETER REGISTERS FOR THE TEST. CAUTION SHOULD BE USED WHEN RUNNING THESE MODULES BECAUSE CUSTOMER DATA COULD BE DESTROYED.

- D8860 RESTART FMD CONTROLLER -
 ISSUES A RESET COMMAND TO THE FMD CONTROLLER TO
 CORRECT A HUNG CONDITION. AL=1.
- D8861 SEEK DISK ADDRESS -
 PERFORM A SEEK TO THE ADDRESS SELECTED IN PARAMETER
 P0, P2, and P3. AL=4.
- D8862 WRITE ONE SECTOR -
 WRITE THE SECTOR SELECTED IN PARAMETER P0, P2, AND
 P3. AL=4.
- D8863 READ ONE SECTOR -
 READ THE SECTOR SELECTED BY PARAMETERS P0, P2 and P3.
 AL = 4.
- D8864 WRITE/READ THE SECTOR -
 WRITE AND READ ONE SECTOR AS SELECTED BY THE P0, P2,
 AND P3 PARAMETERS. AL = 4.
- D8865 TOGGLE PARAMETER READ TEST -
 TOGGLE BETWEEN THE UPPER AND LOWER ADDRESS BOUNDARIES
 BY PERFORMING A READ OF THE DATA ON THESE ADDRESSES.
 AL = 4.

HO-7.1/TR-7.1

D88 - FMD SUBSYSTEM CONFIDENCE TEST (Cont'd)

PARAMETERS

THE FOLLOWING PARAMETERS ARE USED BY D88-

NOTE - THE CONFIDENCE PORTION OF THE TEST (MODULES 1 THRU 39) DOES NOT REFERENCE THE PARAMETER REGISTERS.

P0 - LLLL - LOWER CYLINDER
(RIGHT JUSTIFIED, ZERO FILLED)

P1 - UUUU - UPPER CYLINDER
(RIGHT JUSTIFIED, ZERO FILLED)

P2 - LLUU - LOWER AND UPPER TRACKS
(RIGHT JUSTIFIED, ZERO FILLED)

P3 - LLUU - LOWER AND UPPER SECTORS
(RIGHT JUSTIFIED, ZERO FILLED)

P4 - XXXX - ENABLES

XXX1 - FLAW REPORTING

XX1X - CHANGE PATTERN ON TRACK BOUNDARIES

XX2X - CHANGE PATTERN ON CYLINDER BOUNDARIES

NOTE - IF NEITHER TRACK OR CYLINDER BOUNDARIES ARE SELECTED, THE PATTERN CHANGE WILL DEFAULT TO DISK BOUNDARIES.

XX4X - DUMP FIRST EIGHT LOCATIONS OF THE INPUT AND OUTPUT BUFFERS AND THE B0 THROUGH B15 REGISTERS.

P5 - XXXX - DISABLES

XXX1 - ADDRESS CODING

XXX2 - READ DISABLE

XXX4 - WRITE DISABLE

XX1X - GENERATE FIXED PATTERN

P6 - XXXX - DATA CONTROL

0000 - RANDOM DATA SET

THE REAL TIME CLOCK WILL BE USED AS THE STARTER FOR THE RANDOM NUMBER GENERATOR IF BIT 3 IS CLEAR IN P5.

XXXX - RANDOM DATA SET
(NON-ZERO) IF THIS WORD IS NONZERO AND BIT 3 IS CLEAR IN P5, THIS WORD WILL BE USED AS THE STARTER FOR THE RANDOM NUMBER GENERATOR.

XXXX - RANDOM DATA DISABLED
(NON-ZERO) IF THIS WORD IS NONZERO AND BIT 3 IS SET IN P5, THIS WORD WILL BE USED TO GENERATE A FIXED DATA PATTERN.

HO-8/TR-8

D88 - FMD SUBSYSTEM CONFIDENCE TEST (Cont'd)
PARAMETERS (Cont'd)

P7 - 00XY - MARGINS

Y - OFFSETS	X - STROBES
00X0 - NORMAL OFFSETS	000Y - NORMAL STROBES
00X1 - EARLY OFFSETS	001Y - FORWARD STROBES
00X2 - LATE OFFSETS	002Y - REVERSE STROBES
0077 - RUN ALL MARGINS	

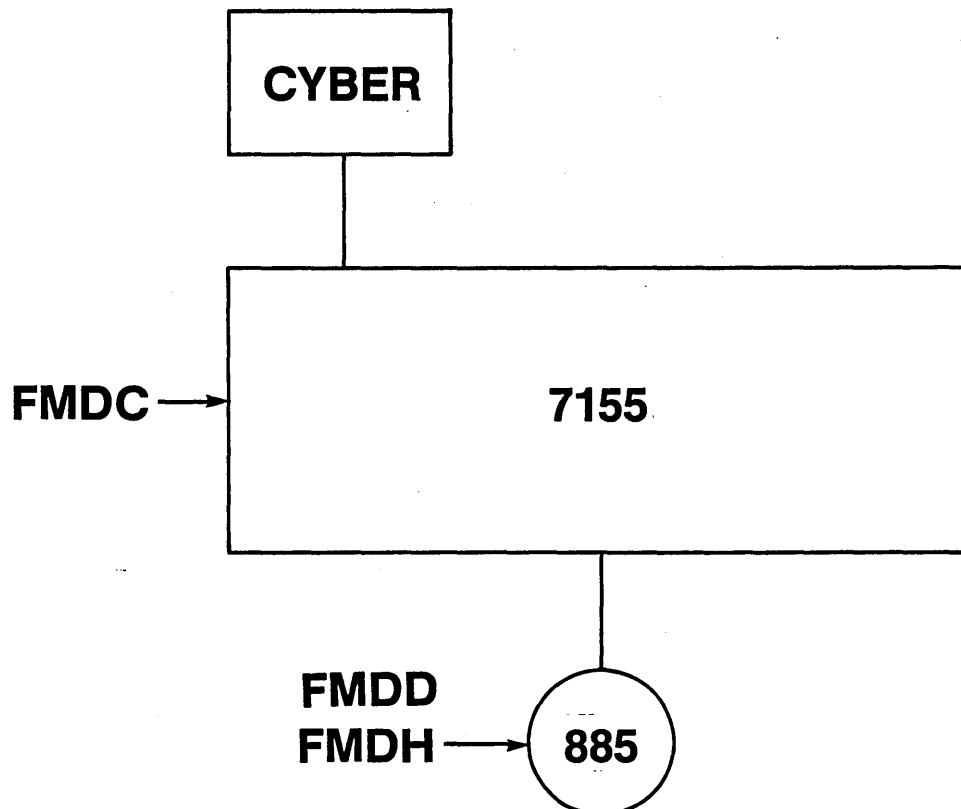
P8 - XXXX - NOT USED

P9 - 0000 - ITERATION COUNT
ITERATION COUNT TIMES 4096 IF RANDOM COUNT.
THIS PARAMETER IS USED BY MODULES 40-50.

HO-9/TR-9

PRESERVICE FORECAST GROUPING

FMDC → **RUN FMC**
FMDD → **RUN FMD**
FMDH → **RUN FMD**



FMC - 7155 CONTROLLER DIAGNOSTIC

<u>SECTION NAME</u>	<u>DESCRIPTION</u>	<u>ACCESS LEVEL</u>	<u>DC</u>
FMC00	PARAMETER VERIFICATION	10	5/7
FMC01	ECHO FUNCTION TEST	10	5/7
FMC02	AUTOLOAD TEST	10	5/7
FMC03	NORMAL CHANNEL LOOP TEST	10	5/7
FMC04	DEADMAN TIMER TEST	21	5/7
FMC07	CYBER SPECIAL CHANNEL TEST	10	5/7
FMC11	Up/Down Counter Test	10	5/7
FMC13	Buffer Mem Adrs Test	10	5/7
FMC15	DATA PATH TEST	10	5/7
FMC18	CONTROL WORD REGISTER TEST	10	5/7
FMC19	BIT COUNTER REGISTER TEST	10	5/7
FMC20	MAINTENANCE LOOP TEST	10	5/7
FMC21	LOOP 885 DECODE TEST	10	5/7
FMC22	LOOP 885 BUS TEST	10	5/7
FMC23	LOOP 885 WRITE/READ/TAG GATE TEST	10	5/7
FMC24	SYNC BYTE SEARCH TEST	10	5/7
FMC25	ECC REGISTER TEST	10	5/7
FMC26	ECC REGISTER CLEAR TEST	10	5/7
FMC27	ECC FUNCTIONAL TEST	10	5/7
FMC28	AUTOLOAD FROM DISK TEST	10	5/7
FMC29	WRITE VERIFY TEST	10	5/7
844-4X			
FMC30	LOOP 885 DECODE TEST	4	5
FMC31	LOOP 885 BUS TEST	4	5
FMC32	LOOP 885 WRT/RD/TAG GATE	4	5
FMC35	ECC REGISTER TEST	3	5
FMC36	ECC REGISTER CLEAR TEST	3	5
FMC37	ECC FUNCTIONAL TEST	3	5
FMC39	WRITE VERIFY TEST	3	5
855-1X			
FMC40	LOOP 885 DECODE TEST	4	7
FMC41	LOOP 885 BUS TEST	4	7
FMC42	LOOP 885 WRT/RD/TAG GATE	4	7
FMC43	SYNC BYTE SEARCH TEST I	4	7
FMC44	SYNC BYTE SEARCH TEST II	4	7
FMC45	ECC REGISTER TEST	3	7
FMC46	ECC REGISTER CLEAR TEST	3	7
FMC47	ECC FUNCTIONAL TEST	3	7
FMC49	WRITE VERIFY TEST	3	7
FMC75	MULTI-CHANNEL CONNECT TEST	10	5/7
FMC76	LED TEST	10	5/7

HO-11/TR-11

FMC - 7155 DISK CONTROLLER DIAGNOSTIC (Cont'd)

PARAMETERS

ALL UNUSED PARAMETERS MUST BE SET TO ZERO. THIS ALLOWS THE PARAMETER CHECKING MODULE TO SOMETIMES DETERMINE IF THE WRONG PARAMETER WAS ACCIDENTALLY SET. THE FOLLOWING PARAMETERS ARE USED BY FMC--

P4 - XXXX - ENABLES

XXX1 - AUTOLOAD FROM DISK
4XXX - ISOLATION

P5 - XXXX - DISABLES

XXX1 - DRIVE MODULES
DISABLING THE MODULES THAT USE THE DRIVE
WILL DEGRADE THE DETECTION/ISOLATION CAPABILITY
OF FMC BY APPROXIMATELY 20 PERCENT.
XX1X - OPERATOR INTERVENTION
1XXX - FULL CONTROLWARE DOWNLOADS

P6 - XXXX - RANDOM DATA SEED
(USE REAL TIME CLOCK IF P6 = 0)

P8 - HARDWARE DESCRIPTION

XXX1 - CHANNEL ACCESS A
XXX2 - CHANNEL ACCESS B (OPTIONAL)
XXX4 - CHANNEL ACCESS C (OPTIONAL)
XX1X - CHANNEL ACCESS D (OPTIONAL)
XX2X - 844 INTERFACE (OPTIONAL)
XX4X - OPTIONAL 885 INTERFACES
XAXX - ACCESS USED BY THIS TEST

A = 0 FOR ACCESS A
A = 1 FOR ACCESS B
A = 2 FOR ACCESS C
A = 3 FOR ACCESS D

P9 - 0Y0Z Y = THIS TEST COPY NUMBER
(0, 1, 2, OR 3)
Z = THE NUMBER OF OTHER
ACCESSES BEING TESTED
(1, 2, OR 3)

HO-12/TR-12

FMD - 7155 FIXED MODULE DIAGNOSTIC

SECTION DESCRIPTION INDEX

<u>NAME</u>	<u>DESCRIPTION</u>	<u>ACCESS LEVEL</u>
FMD00	CHECK PARAMETERS	3
FMD01	FMD PRELIMINARY TEST	3
FMD02	STATIC I/O TEST 1	3
FMD03	STATIC I/O TEST 2	3
FMD04	ILLEGAL COMMAND TEST	3
FMD05	FMD PARITY TEST	3
FMD06	ECHO BUS OUT TEST	3
FMD07	ECHO DECODE TEST	3
FMD08	RTZ CLEAR REG. TEST	3
FMD09	UPPER CYLINDER TEST	3
FMD10	LOWER CYLINDER TEST	3
FMD11	UPPER DIFF. TEST	3
FMD12	LOWER DIFF. TEST	3
FMD13	HEAD REGISTER TEST	3
FMD14	48, 49 STATUS TEST	3
FMD15	4A, 4B STATUS TEST	3
FMD16	4C, 4E, 4F STATUS TEST	3
FMD17	4C BIT 0 STATUS TEST	3
FMD18	4C BIT 4 STATUS TEST	3
FMD19	4C BIT 5 STATUS TEST	3
FMD20	4C BIT 6 STATUS TEST	3
FMD21	4C BIT 7 STATUS TEST	3
FMD22	46, 47 STATUS TEST	3
FMD23	4D BIT 3 STATUS TEST	3
FMD24	4D BIT 4 STATUS TEST	3
FMD25	4D BIT 5 STATUS TEST	3
FMD26	4D BIT 6 STATUS TEST	3
FMD27	88-8F STATUS TEST	3
FMD28	8A, 8D STATUS TEST	3
FMD29	DRIVE ADDRESS TEST	3
FMD30	MAINT/RD SWITCH TEST	3
FMD31	SECTOR COMP. TEST 1	3
FMD32	SECTOR COMP. TEST 2	3
FMD33	SECTOR COUNTER TEST	3
FMD34	RTZ STATUS TEST 1	3
FMD35	RTZ STATUS TEST 2	3
FMD36	ONE TRACK SEEK TEST	3
FMD37	SEEK 2, 4, 8 TRACKS	3
FMD38	SEEK 16, 32, 64 TRACKS	3
FMD39	SEEK 128, 256, 512 TRK	3
FMD40	842 TRACK SEEK TEST	3
FMD41	INCREMENTAL SEEKS	3
FMD42	TIMED RANDOM SEEKS	3
FMD43	OFFSET TEST 1	3
FMD44	OFFSET TEST 2	3
FMD45	OFFSET TEST 3	3
FMD46	READ ADDRESS FIELD	3

H0-13/TR-13

FMD - 7155 FIXED MODULE DIAGNOSTIC (Cont'd)

SECTION DESCRIPTION INDEX

<u>NAME</u>	<u>DESCRIPTION</u>	<u>ACCESS LEVEL</u>
FMD47	READ DATA FIELD	3
FMD48	READ ADDRESS FORWARD	3
FMD49	READ ADDRESS REVERSE	3
FMD50	RANDOM READ TEST	3
FMD51	COMPARE DATA FIELD	3
FMD52	WRITE/READ TEST	3
FMD53	W/R LATE STROBE	3
FMD54	W/R EARLY STROBE	3
FMD55	W/R REVERSE OFFSET	3
FMD56	W/R REV/LATE MARGIN	3
FMD57	W/R REV/EARLY MARGIN	3
FMD58	W/R FORWARD OFFSET	3
FMD59	W/R FWD/LATE MARGIN	3
FMD60	W/R FWD/EARLY MARGIN	3
FMD61	VERIFY ADDRESS FIELD	3
FMD62	READ CONTROL FAULT	3
FMD63	WRITE CONTROL FAULT	3
FMD64	OFFSET WRITE FAULT	4
FMD65	W/R CONTROL FAULT	4
FMD66	OFF CYL. READ FAULT	3
FMD67	SEEK OVERSHOOT FAULT	3
FMD68	INDEX READ FAULT	3
FMD69	W/R DATA FIELD	3
FMD70	SERVO TEST	3
FMD71	RESONANCE TEST 1	3
FMD72	RESONANCE TEST 2	3
FMD73	TEST DUAL ACCESS	10

HO-14/TR-14

FMD - 7155 FIXED MODULE DIAGNOSTIC (Cont'd)

PARAMETERS

P0 - LLLL - LOWER CYLINDER
(RIGHT JUSTIFIED, ZERO FILLED)

P1 - 0000 - UPPER CYLINDER
(RIGHT JUSTIFIED, ZERO FILLED)

P2 - LLUU - LOWER AND UPPER TRACKS

P3 - LLUU - LOWER AND UPPER SECTORS

P4 - XXXX - ENABLES
XXX1 - FLAW REPORTING
XXX2 - NOT USED (MUST BE 0)
XXX4 - NOT USED (MUST BE 0)
XX1X - NOT USED (MUST BE 0)
XX2X - NOT USED (MUST BE 0)
XX4X - NOT USED (MUST BE 0)
X1XX - NOT USED (MUST BE 0)
X2XX - NOT USED (MUST BE 0)
X4XX - NOT USED (MUST BE 0)
1XXX - NOT USED (MUST BE 0)
2XXX - ISOLATE READY AND SAFE FAILURES
4XXX - ISOLATION

P5 - XXXX - DISABLES
XXX1 - DATA CHECKING
XXX2 - DATA CHECKING AFTER FIRST ERROR
XXX4 - HALT ON DATA ERROR
XX1X - OPERATOR INTERVENTION
XX2X - NOT USED (MUST BE 0)
XX4X - NOT USED (MUST BE 0)
X1XX - NOT USED (MUST BE 0)
X2XX - NOT USED (MUST BE 0)
X4XX - NOT USED (MUST BE 0)
1XXX - NOT USED (MUST BE 0)
2XXX - DISABLE RESERVE FUNCTIONS
4XXX - FORCE DRIVE FAULTS

P6 - XXXX - RANDOM DATA SEED
(USE REAL TIME CLOCK IF P6 = 0)

P7 - NOT USED.

P8 - HARDWARE DESCRIPTION

XAXX - COPY OF TEST BEING RUN
A = 1 FOR COPY 0
A = 2 FOR COPY 1

P9 - 0000 - ITERATION COUNT
(ACTUAL COUNT EQUALS THE ITERATION)
HO-15/TR-15

D44 - AN 844 DIAGNOSTIC

D44 IS A SERIES OF DIAGNOSTICS FOR 7X54 AND FMD CONTROLLERS WITH 844 2X AND 4X DISK DRIVES. THE DIAGNOSTIC IS DIVIDED IN THREE PARTS. PART I CONSISTS OF MODULES WHICH ARE CONFIDENCE LEVEL DIAGNOSTICS. THE BASIC INDIVIDUAL FUNCTIONS ARE CHECKED BEFORE CHECKING THE FEATURES INVOLVING A COMBINATION OF THESE BASIC FUNCTIONS. EACH MODULE IS A SEPARATE ENTITY, THAT CAN BE LOOPED ON ITSELF. THESE MODULES HAVE NO PARAMETER INPUT.

PART II CONSISTS OF INDIVIDUAL SELECTABLE MODULES IN PRESCRIBED MODES DRIVEN BY PARAMETER INPUT. THE TWO SURFACE TESTS IN THIS SERIES ARE NOT PARAMETER DRIVEN. THESE TESTS ANALYZE THE FULL DISK PACK.

PART III CONSISTS OF INDIVIDUAL MAINTENANCE MODULES TO LOOP ON PRESCRIBED AREAS OF DISK OR CONTROLLER FUNCTIONS. PARAMETER INPUT IS USED WHERE APPLICABLE.

PART I MODULE DESCRIPTIONS CONFIDENCE LEVEL DIAGNOSTICS

MODULE 00 - CONNECT TEST - AL = 1.
MODULE 01 - GENERAL STATUS TEST - AL = 1.
MODULE 02 - DETAIL STATUS TEST - AL = 1.
MODULE 03 - DIAGNOSTIC WRITE/READ TEST - AL = 1.
MODULE 04 - CYLINDER SEEK TEST - AL = 1.
MODULE 05 - READ PACK FLAWED SECTOR TEST - AL = 3.
MODULE 06 - READ INNERMOST CYLINDER TEST - AL = 3.

NOTE - MODULE 41 MUST HAVE PREVIOUSLY WRITTEN THIS CYLINDER.
MODULE 6 CAN BE USED AS A COMPATIBILITY CHECK IF MODULE 41 IS RUN ONCE PER PACK ON A PROPERLY ALIGNED DRIVE.

MODULE 07 - READ COUPLER BUFFER TEST - (7154 ONLY) - AL = 3.
MODULE 08 - WRITE FIRST 2 PREALLOCATED CYLINDERS TEST - AL = 3.
MODULE 09 - READ FIRST 2 PREALLOCATED CYLINDERS TEST - AL = 3.
MODULE 10 - FORCE CHECKWORD ERROR TEST - AL = 3.
MODULE 11 - WRITE VERIFY TEST - AL = 3.
MODULE 12 - READ CHECKWORD TEST - AL = 2.

HO-16/TR-16

D44 - AN 844 DIAGNOSTIC (Cont'd)

MODULE 13 - CHECK MARGIN TEST - AL = 3.
MODULE 14 - RANDOM SEEK TEST - AL = 3.
MODULE 15 - WRITE CODED CYLINDER TEST - AL = 3.
MODULE 16 - READ CODED VERIFY TEST - AL = 3.
MODULE 17 - READCW SEQUENTIAL DISK TEST - AL = 3.

PART II MODULE DESCRIPTION - PARAMETER DRIVEN-INDIVIDUAL SELECTABLE

MODULE 30 - SEQUENTIAL WRITE/READ, TRACK MODE, 2/1 - AL = 4.
MODULE 31 - SEQUENTIAL WRITE/READ, CYLINDER MODE, 2/1 - AL = 4.
MODULE 32 - SEQUENTIAL WRITE/READ, TRACK MODE, 1/1 - AL = 4.
MODULE 33 - SEQUENTIAL WRITE/READ, CYLINDER MODE, 1/1 - AL = 4.
MODULE 34 - RANDOM WRITE/READ, ONE CYL, TRK, SEC - AL = 4.
MODULE 35 - SURFACE TEST, TRACK MODE, 2/1 - AL = 4.
MODULE 36 - SURFACE TEST, CYLINDER MODE, 1/1 - AL = 4.
MODULE 37 - HEAD TEST, TRACK GROUPS, 2/1 - AL = 4.
MODULE 38 - HEAD TEST, TRACK GROUPS, 1/1 - AL = 4.

PART III MODULE DESCRIPTIONS - REPAIR MODULES - INDIVIDUAL MAINTENANCE

MODULE 40 - RESTART BUFFER CONTROLLER REPAIR TOOL - AL = 3.
MODULE 41 - PRESET WRITE PROGRAM FOR MODULE 06 - AL = 3.
MODULE 42 - SEEK DISK ADDRESS - AL = 3.
MODULE 43 - WRITE ONE SECTOR - AL = 4.
MODULE 44 - READ ONE SECTOR - AL = 3.
MODULE 45 - WRITE AND READ ONE SECTOR - AL = 4.
MODULE 46 - TOGGLE TEST - AL = 3.
MODULE 47 - DEAD MAN TERMINATOR TEST - AL = 21.
MODULE 48 - READ AND PRINT FLAW MAPS - AL = 4.

HO-17/TR-17

D44 - AN 844 DIAGNOSTIC (Cont'd)

PARAMETERS

P0 = LOWER CYLINDER (RIGHT JUSTIFIED, ZERO FILLED)

P1 = UPPER CYLINDER (RIGHT JUSTIFIED, ZERO FILLED)

P2 = (LLUU) LL = LOWER/UPPER TRACKS

P3 = (LLUU) LL = LOWER/UPPER SECTORS

P4 = ENABLES

 BITS 0 - REPORT FLAWS

 1 - FULL INPUT BUFFER DUMP ON COMPARE ERRORS.

 2 - COMPARE DATA (MODULES 30 THRU 32)
 (MODULES 37 AND 38)

 3 - CHANGE PATTERN ON TRACK BOUNDARIES.

 4 - CHANGE PATTERN ON CYLINDER BOUNDARIES.

 *IF NEITHER TRACK OR CYLINDER BOUNDARIES ARE
 SET, THE PATTERN CHANGE WILL DEFAULT TO
 DISK BOUNDARIES.

P5 = DISABLES

 BITS 0 - ADDRESS CODING

 1 - READ

 2 - WRITE

 3 - RANDOM DATA TO BUFFER

 4 - RESET COMMAND

P6 = DATA CONTROL

 (ZERO - AND RANDOM DATA SET (BIT 3 CLEAR IN P5)
 THE RANDOM START KEY WORD WILL COME FROM
 THE REAL TIME CLOCK.

 (NON-ZERO) - AND RANDOM DATA SET (BIT 3 CLEAR IN P5)
 THE RANDOM START WILL USE THIS DATA CONTROL
 WORD AS THE KEY START WORD.

 (NON-ZERO) - AND RANDOM DATA DISABLED (BIT 3 SET IN P5) THE
 BUFFER WILL BE FILLED WITH THIS FIXED DATA CONTROL
 WORD.

P7 = (00YX) MARGINS

 Y = STROBES
 NORMAL 000X
 EARLY 001X
 LATE 002X

 X = OFFSETS
 NORMAL 00Y0
 FORWARD 00Y1
 REVERSE 00Y2

P8 = ITERATION COUNT

 (ITERATION COUNT TIMES 4096 IF RANDOM COUNT)

HO-18/TR-18

DTC - 844-4X DISK DRIVE DIAGNOSTIC

<u>SECTION NAME</u>	<u>DESCRIPTION</u>	<u>ACCESS LEVEL (MINIMUM)</u>
DTC00	PARAMETER CHECK	1
DTC01	DRIVE SELECT/DESEL/RTZ TEST	3
DTC02	DRIVE REGISTER POSITION TEST	3
DTC03	DRIVE REGISTER BIT TEST	3
DTC04	SPINDLE SPEED TEST	3
DTC05	SECTOR COUNTER TEST	1
DTC06	SEEK CYLINDER ADDRESS +1 INCR TEST	1
DTC07	SEEK CYLINDER ADDRESS -1 DECR TEST	1
DTC08	SEEK CYLINDER IN INCREASING INCR/DECR TEST	1
DTC09	TOTAL CYLINDER SEEK TIME TEST	1
DTC10	SEQUENTIAL CYLINDER SEEK TIME TEST	1
DTC11	AVERAGE CYLINDER SEEK TIME TEST	1
DTC12	READ ADDRESS TEST	1
DTC13	WRITE VERIFY TEST	**** 3 OR 4
DTC14	READ/WRITE TEST	**** 3 OR 4
DTC15	HEAD ADVANCE TEST	**** 3 OR 4
DTC16	READ/WRITE INTERLACING TEST	**** 3 OR 4
DTC17	OFF CYLINDER READ FAULT TEST	3
DTC18	OFF CYLINDER WRITE FAULT TEST	4
DTC19	SEEK CYLINDER FAULT TEST	3
DTC20	DUAL ACCESS TEST	10

NOTE:

- **** - AN ACCESS LEVEL OF 3 IS REQUIRED FOR R/W ON PRE-ALLOCATED CYLINDERS (1464-1466).
- **** - AN ACCESS LEVEL OF 4 IS REQUIRED FOR R/W OUTSIDE THE PRE-ALLOCATED CYLINDERS.

HO-19/TR-19

DTC - 844-4X DISK DRIVE DIAGNOSTIC (Cont'd)

PARAMETERS

THE FOLLOWING PARAMETRS ARE USED BY DTC--

P0 - XXXX CONTAINS LOWER CYLINDER ADDRESS LIMIT -RIGHT JUSTIFIED,
 ZERO FILLED (LEGAL ADDRESSES ARE 0-1466B)

P1 - XXXX CONTAINS UPPER CYLINDER ADDRESS LIMIT -RIGHT JUSTIFIED,
 ZERO FILLED (LEGAL ADDRESSES ARE 0-1466B)

P2 - XXXX UPPER 6 BITS CONTAIN LOWER TRACK
 LLUU ADDRESS LIMIT (LEGAL VALUES ARE 0-22B)

 LOWER 6 BITS CONTAIN UPPER TRACK
 ADDRESS LIMIT (LEGAL VALUES ARE 0-22B)

P3 - XXXX UPPER 6 BITS CONTAIN LOWER SECTOR
 LLUU ADDRESS LIMIT (LEGAL VALUES ARE 0-27B)

 LOWER 6 BITS CONTAIN UPPER SECTOR
 ADDRESS LIMIT (LEGAL VALUES ARE 0-27B)

P4 - XXXX ENABLES

 XXX1 ENABLE FULL PACK SEEKS

P5 - XXXX DISABLES

 XX1X DISABLES SCRATCH PAK MESSAGE
 FOR DTC12-DTC16

 XX2X DISABLES MANUAL OPERATION MESSAGE
 FOR DTC20

 2XXX DISABLES OPPOSITE CHANNEL RESERVE

P6 - XXXX DATA PATTERN SELECTION

 XX00 ANY VALUE BETWEEN 0 and 57
 XX57 WILL SELECT ONE DATA PATTERN

 XX77 SELECT ALL DATA PATTERNS

DTC - 844-4X DISK DRIVE DIAGNOSTIC (Cont'd)

P7 - XXAB MARGINS (OFFSET/STROBES)

- XXX0 - NORMAL OFFSETS
- XXX1 - FORWARD OFFSETS
- XXX2 - REVERSE OFFSETS
- XX0X - NORMAL STROBES
- XX1X - EARLY STROBES
- XX2X - LATE STROBES
- 7777 - DEFAULT - RUNS ALL MARGIN CONDITIONS

P8 - XAAA - COPY SELECTION FOR DTC20

- X100 - SELECT COPY 1 (DTC20A) OF DTC20
- X200 - SELECT COPY 2 (DTC20B) OF DTC20

P9 - XXXA - VERBAL/OCTAL ERROR DISPLAY

- XXX0 - DEFAULT - OCTAL STATUS DISPLAY
- XXX1 - VERBAL STATUS DISPLAY

NOTE - ONE CYLINDER = 19D TRACKS AND 24D SECTORS/TRACK

HO-21/TR-21

FMU MODULES

<u>MODULE NUMBER</u>	<u>MODULE DESCRIPTION</u>	<u>PARA- METERS</u>	<u>ACCESS LEVEL</u>
885-1X MODULES (DC=7)			
FMU01	READ 885 SERIAL NUMBER	NONE	3
FMU02	READ 885 FACTORY MAPS	P0	3
FMU03	READ 885 UTILITY MAPS	P0, P4	3
FMU04	SET 885 SECTOR FLAW	P1, P2, P3	4
FMU05	CLEAR 885 SECTOR FLAW	P1, P2, P3	4
FMU06	FORMAT 885 PACK	NONE	4
FMU07	FORMAT PARTIAL 885 PACK	P6, P7	4
FMU10	FORMAT 885 UTILITY TRACK	P8, P9	4
FMU11	SCAN AND DISPLAY 885 FLAWS	NONE	1
FMU12	VERIFY 885 MAPS	NONE	3
FMU13	ARCHIVE 885 MAPS	NONE	3
FMU14	RESTORE 885 UTILITY MAPS	P5	3
FMU15	COPY CONTROLWARE TO 885	NONE	3
FMU16	READ 7155 CONTROLWARE REV	NONE	1
FMU17	WRITE DIAGNOSTIC TRACKS	NONE	3
855-4X Modules (DC=14)			
FMU21	READ 885-4X SERIAL NUMBER	NONE	3
FMU22	READ 885-4X FACTORY MAPS	P0	3
FMU23	READ 885-4X UTILITY MAPS	P0, P4	3
FMU24	SET 885-4X SECTOR FLAW	P1, P2, P3	4
FMU25	CLEAR 885-4X SECTOR FLAW	P1, P2, P3	4
FMU26	FORMAT 885-4X PACK	NONE	4
FMU27	FORMAT PARTIAL 885-4X PACK	P6, P7	4
FMU30	FORMAT 885-4X UTILITY TRACK	P8, P9	4
FMU31	SCAN + DISPLAY 885-4X FLAWS	P6, P7	1
FMU32	VERIFY 885-4X MAPS	NONE	3
FMU33	ARCHIVE 885-4X MAPS	NONE	3
FMU34	RESTORE 885-4X UTILITY MAPS	P5	3
FMU35	COPY CONTROLWARE TO 885-4X	NONE	3
FMU36	READ 7155 CONTROLWARE REV	NONE	1
FMU37	WRITE DIAGNOSTIC TRACKS	NONE	3
844 MODULES (DC-5)			
FMU41	READ 844 SERIAL NUMBER	NONE	10
FMU42	READ 844 FACTORY MAP	P0	10
FMU43	READ 844 UTILITY MAP	P0, P4	10
FMU45	SET 844 SECTOR FLAW	P1, P2, P3	10
FMU46	CLEAR 844 SECTOR FLAW	P1, P2, P3	10
FMU47	SET 844 TRACK FLAW	P1, P2	10
FMU50	CLEAR 844 TRACK FLAW	P1, P2	10
FMU51	FORMAT 844 PACK	NONE	10
FMU52	FORMAT PARTIAL 844 PACK	P6, P7	10
FMU55	SCAN AND DISPLAY 844 FLAWS	P4	10
FMU57	ARCHIVE 844 MAPS	NONE	10
FMU60	RESTORE 844 MAPS	P5	10
FMU61	COPY CONTROLWARE TO 844	NONE	10
FMU65	DISPLAY 7155 MEMORY	P0-P7	10

HO-22/TR-22

FMU PARAMETERS

<u>Parameter</u>	<u>Format</u>	<u>Description</u>
	0000	Display/print both tables
P0	0001	Display/print track flaw table only
	0002	Display/print sector flaw table only
P1	XXXX	Cylinder number
P2	00XX	Track number
P3	00XX	Physical sector number
P4 (885)	0000	Do not sort track/sector flaw table(s)
	0001	Sort track/sector flaw table(s)
P4 (844)	0000	Do not modify 844 utility map sector
	0001	Copy sector/track flaw list to 844 utility map sector
P5	0000	Transfer archived utility map data to pack utility map
	0001	Transfer archived factory map data to pack utility map
P6	XXXX	Starting cylinder number
P7	XXXX	Ending cylinder number
P8 (885)	00XX	885 utility track first skipped sector
P9 (885)	00XX	885 utility track second skipped sector
P8 (844)	0XXXD	Upper three digits of 844 pack serial number
P9 (844)	0XXXD	Lower three digits of 844 pack serial number

HO-23/TR-23

CYBER FMD SERIAL APPLICATION
STUDENT LAB MANUAL

SAFETY PRACTICES

All engineers are expected to follow reasonable and appropriate precautions with respect to electrical, mechanical, and personal safety hazards while working on computer system equipment. Note the entries in the maintenance documentation labeled DANGER or WARNING that identify hazardous areas or procedures encountered in maintaining the system equipment. The following additional procedures should be followed when working on equipment.

Personal:

1. Ensure that none of your actions cause unsafe conditions that may expose customer personnel to hazards in any device.
2. Never work alone on equipment that has exposed operating mechanical parts or exposed hazardous power components. If you must do so, notify your EIC or manager. In any case, the following precautions must be observed.
 - a. Someone familiar with the power-off controls must be in the immediate area.
 - b. Personal jewelry (rings, wristwatches, bracelets, necklaces, etc.) must be removed. A small box in the CE tool kit will make a good storage place for these items.
 - c. When using only one hand, keep the other hand in your pocket.
 - d. Avoid wearing loose articles of clothing that can be snagged and drawn into moving machinery. Wear short-sleeved shirts or roll sleeves above the elbow. Neckties, where required, should be tucked in between the second and third shirt button or fastened about three inches from the end with a tacket or tie clasp, preferably nonconductive. Clip-on neckties are preferable to the regular ones; if caught, they pull free without causing injury.
 - e. Before starting equipment, make sure that no other CE or customer personnel are in a position where they could get hurt.
 - f. While working in equipment, put red tape strips across any power controls or use DO NOT OPERATE tags where available.

CYBER FMD SERIAL APPLICATION
Safety Practices (cont'd)

3. Keep CE tool kits out of walkways; put them on or under a desk or table.
4. Put doors and covers that you remove from a machine in a safe, out-of-the-way location where no one can trip over them or cause them to fall and injure another person. All machine covers must be in place before the machine is returned to the customer.
5. All safety covers, guards, shields, groundtraps, panels, etc., must be properly reinstalled after maintenance is finished.
6. Maintain good housekeeping practices during and following each maintenance activity. Do not permit tools, manuals, wipers, paper, or trash to accumulate in the work area; clean up after yourself.

Electrical:

1. Shut off all AC and DC power when removing or installing major assemblies, working inside power supplies or power control enclosures, performing detailed mechanical maintenance procedures, or wiring and/or changing modules in the machine. If possible, turn off and lock or tag the circuit breaker in the service panel on the wall; unplug the main power supply cord.
2. Use only well-insulated pliers, screwdrivers, test leads, etc., when working on or near live circuits.
3. Do not disconnect or disable safety grounding systems even if the equipment is powered off. These are installed for your protection.
4. Avoid touching grounds, such as equipment frames, metal floor tile edgings, and electrical conduits. If possible, purchase rubber or vinyl mats.

Mechanical

1. Do not use chemicals, grease, oil, or solvents that have not been specifically approved by the equipment manufacturer for that device. Such recommendations are usually based on extensive experience with the equipment in service.

CYBER FMD SERIAL APPLICATION
Safety Practices (cont'd)

2. Use the proper tools for the job. Improper use of tools can result in personal injury or equipment damage.
3. Immediately replace worn or broken tools or test equipment.
4. If the machine is running, do not reach into the works; remember, they are your fingers and you only get one set per lifetime.
5. If using a strobelight on mechanical devices, don't touch the equipment because it may be moving.
6. Safety glasses or goggles must be used if you are - -
 - a. Driving pins, riveting, swaging, or similar activities.
 - b. Using an electric drill, grinder, reamer, etc.
 - c. Installing or removing springs under tension or compression.
 - d. Using any type of solvent, spray, or chemical for cleaning or touch-up painting.
 - e. Engaging in any other activity that may endanger the eyes. They are your eyes, and you need them for this type of work.
7. When lifting, use a method that will not injure the spine or strain the back muscles. Be realistic about your capacity for lifting.
8. Use good judgment and common sense. A moment of thought before you act can save hours of agonizing afterthought.

CYBER FMD SERIAL APPLICATION
STUDENT LAB MANUAL

DAY 1

TOPICS: Diagnostics, Troubleshooting

OBJECTIVES: 1, 2, 3, 4, 5, 6, 8, 9, 12

REFERENCE MATERIALS:

- 7155 Reference Manual #60455860
- FA211 Hardware Maint. Manual #GF60455690
- BZ703/BZ708 Hardware Ref. Manual #83322880
- BZ703 Hardware Maint. Manual Vol. 1 #GF83322860
- BZ703 Hardware Maint. Manual Vol. 2 #GF83322870
- 7155 Troubleshooting Guide #60456010
- 7155 Operator Maint. Guide #60456650
- Malet Docu. Microfiche #53140094

EQUIPMENT/TOOLS:

- 6000, or CYBER 7X, or CYBER 17X Computer with Serial FMD Subsystem
- Oscilloscope
- Standard site tools
- Special tools/test equipment as listed in FA211 manual #GF60455690 and BZ703 manual #GF83322860
- Microfiche Viewer

PROCEDURES:

NOTE: You will run the diagnostics/troubleshoot on-line (CML) from the system console and remote terminal and off-line (MSL/SMM) from the system console. Your instructor will specify the method(s) to use each day. Your instructor will direct you to the equipment to be used for lab.

CYBER FMD SERIAL APPLICATION

1. Deadstart

SETUP: Insure the equipment to be used is powered up and ready.
NOTE: Your instructor will direct you if the diagnostics are to be run on-line and/or off-line.

- a. On-line = Refer to site deadstart settings and deadstart NOS/NOSBE. Then bring up MALET using PROCEDURE 1-8 and 1-8A or 1-8B in the 7155 Troubleshooting Guide.
- b. Off-line = Refer to site deadstart settings or refer to Table 1-11 in the 7155 Troubleshooting Guide and deadstart MSL/SMM. Then bring up DEMOT using PROCEDURE 1-8C (MSL), or MALET using PROCEDURE 1-8D (SMM) in the 7155 Troubleshooting Guide.

2. Controlware

- a. On-line = Controlware is normally loaded during system deadstart. Controlware may also be loaded using the LOADBC command, refer to Table 1-2A/B step 100 in the 7155 Troubleshooting Guide. Controlware must first be stored as a permanent file refer to PROCEDURE 1-1B in the 7155 Troubleshooting Guide.
- b. Off-line = Controlware may be loaded under DEMOT (MSL) using the CW, CW885 command refer to PROCEDURE 1-8C step 7 or under MALET (SMM) using the BCL routine refer to PROCEDURE 1-8D step 7 in the 7155 Troubleshooting Guide.

NOTE: Controlware may also be loaded using FMC module 2 or module 28. FMC module 28 loads controlware from the 885. The controlware must first be stored on the disk using FMU.

Instructor Checkpoint _____

3. Diagnostic Usage

NOTE: Your instructor will specify the method(s) to use to run the tests. If any error(s) occur, look up the error code and interpret the message. Your instructor will direct you if a maintenance procedure is required.

a. FMC

- 1) What is the channel number for the 7155 to be tested?
4
- 2) What is the device number for the 885 to be tested?
40
- 3) What is the device code for the 885-1X?
7
- 4) What is the access level(s) required for FMC?
10
- 5) Use PROCEDURE 1-6 in the 7155 Troubleshooting Guide to run FMC.
- 6) How must the parameter(s) be changed to allow module 2 to load controlware?
P5 = 0XXX, P5 = 1XXX
- 7) How must the parameters(s) be changed to allow the AUTOLOAD FROM DISK TEST module to load controlware?
P4 = XXX1
- 8) Run FMC with parameters changed to load controlware.
P5 = 0010
- 9) Run the FMC LED test, with parameters changed for operator intervention.
FMC 76 P5 = XX0X
- 10) Run FMC with parameter change to disable drive modules.
P5 = XXX1

b. D88

- 1) What access level is required for all Confidence/Verification modules to run?
- 2) Use PROCEDURE 1-3 in the 7155 Troubleshooting Guide to run D88.
- 3) What D88 module reads the data that were written by FMU 17?
- 4) Run the Parameter Drive Module D8846 on one sector, one head, and toggle between two cylinders.
- 5) Run the Repair Module D8863.
- 6) Run the remaining Parameter and Repair Modules of D88.

c. FMD

- 1) The 7155 Troubleshooting Guide suggests setting parameter 4 to 4000 and parameter 5 to 0010.
- 2) What is the access level(s) required for FMD?
- 3) Use PROCEDURE 1-4 in the 7155 Troubleshooting Guide to run FMD modules 0 through 70.
- 4) What modules of FMD require an access level of 4?
- 5) Run FMD with the device maintenance switch off. Which module(s) fail?
- 6) Run FMD with parameters changed for operator intervention. Which modules stop for intervention?

d. D44 (if 844 drives are on the 7155 subsystem)

- 1) What access level is required for all confidence level modules to run? 3
- 2) What module must have been previously run on the disk pack before module 6 will run? 41
- 3) Check to insure a scratch pack is installed on the 844 unit to be tested.
- 4) Use PROCEDURE 1-7 in the 7155 Troubleshooting Guide to run D44.
- 5) Your instructor will direct you if additional modules are to be run.

e. DTC (if 844 drives are on the 7155 subsystem)

- 1) What access level(s) is required to run DTC? 3 & 4
- 2) Check to insure a scratch pack is installed on the 844 unit to be tested.
- 3) Use PROCEDURE 1-5 in the 7155 Troubleshooting Guide to run DTC.
- 4) What value does the 7155 Troubleshooting Guide specify for the cylinder address limits?
P0 = 1464 P1 = 1464
- 5) The 7155 Troubleshooting Guide specific P6 = 1 this specifies DATA PATTERN 1.
- 6) The 7155 Troubleshooting Guide specifies P7 = 1 this specifies FORWARD OFFSETS.
- 7) With the parameter settings specified by the 7155 Troubleshooting Guide what head and sector is selected?
HEAD 0
SECTOR 0

SLM-8

f. FMU

NOTE: Refer to Operator Maintenance Guide

- 1) Run FMU modules 99,99A then modules to read 885 serial number, *FMU01*
factory maps, utility maps, and set and clear a flaw bit.
FMU02 FMU03 FMU05 FMU06
- 2) Run FMU modules to copy Controlware to 885, read 7155,
Controlware Rev, and write diagnostic tracks.
FMU21 FMU23 NEW VERSION 15-17
- 3) Run FMU module 65 to display the 7155 processor memory starting
at address 20,000 octal.
P0 = 2 P1 = 0000
- 4) Your instructor will direct you if you are to run any remaining
modules.
- 5) If a 844 drive is on the 7155 subsystem your instructor will
specify which of the 844 modules you are to run.
- 6) What access level is required by the FMU modules for the 844?

Instructor Checkpoint 10

4. Signal Checks

DIRECTIONS: Use the Oscilloscope to check the following signals.

a. 885

- 1) INDEX = Location A/B 38 - pin 6A. *16.2*
- 2) SECTOR PULSE = Location A/B 28 - pin 12A. *500 uSES*
- 3) SERVO CLOCK (4.8 MHZ) = Location A/B 40 - pin 32B. *3.75 uSES*
- 4) SERVO CLOCK (300 KHZ) = Location A/B 40 - pin 11B

o Use D88 to Command Repeat Seeks and Scope -

- 5) START SEEK = Location A/B 33 - pin 21B.
- 6) ON TRK = Location A/B 33 - pin 15B.
- 7) DAC = Location A/B 36 - pin 19B.
- 8) FILL IN INTEG = Location A/B 36 - pin 31B.
- 9) VEL = Location A/B 37 - pin 18B.
- 10) + POSITION = Location A/B 37 - pin 23B.
- 11) LOAD CMD REG = Location A/B 22 - pin 43B.
- 12) LOAD BUS REG = Location A/B 22 - pin 38B.
- 13) TAG GATE = Location A/B 23 - pin 45B.

o Use D88 to Command Write Operation and Scope -

- 14) WRITE GATE = Location A/B 07 - pin 45B.
- 15) NRZ WRITE DATA = Location A/B 07 - pin 40A.
- 16) MFM WRITE DATA = Location A/B 07 - pin 44B.

o Use D88 to Command Read Operation and Scope -

- 17) READ GATE = Location A/B 21 - pin 39B.
- 18) NRZ READ DATA = Location A/B 21 - pin 06A.
- 19) READ CLOCK = Location A/B 21 - pin 09B.

b. 7155

- 1) 10 MHZ CLOCK = Location A01 - TP31.
 - o Use FMC01 to issue Function Signal and Scope -
- 2) FUNCTION = Location A01 - TP36.
 - o Use D88 to Command Write Operation and Scope -
- 3) WRITE DATA FF = Location B22 - TP44 (and write path).
 - o Use D88 to Command Read Operation and Scope -
- 4) READ DATA FF = Location B22 - TP25 (and read path).
 - o Jumper Location A08 - pin PlB~~22~~^{P1B03} to Location A08.
pin PlA04 and Scope -
- 5) RNI = Location A22 - pin PlB12.
- 6) PROGRAM SYNC = Location A27 - TP50.
- 7) MS and AS processor signals = Location A22 - refer to
AH logic diagrams sheet 3 for pin numbers.

Instructor Checkpoint _____

CYBER FMD SERIAL APPLICATION
STUDENT LAB MANUAL

DAY 2

TOPICS: Diagnostics, Troubleshooting

OBJECTIVES: 1, 3, 5, 7, 10, 11, 12

REFERENCE MATERIALS:

7155 Reference Manual #60455860
FA211 Hardware Maint. Manual #GF60455690
BZ703/BZ708 Hardware Ref. Manual #83322880
BZ703 Hardware Maint. Manual Vol. 1 #GF83322860
BZ703 Hardware Maint. Manual Vol. 2 #GF83322870
7155 Troubleshooting Guide #60456010
7155 Operator Maint. Guide #60456650
Malet Docu. Microfiche #53140094

EQUIPMENT/TOOLS:

6000, or CYBER 7X, or CYBER 17X Computer with Serial
FMD Subsystem
Oscilloscope
Standard Site Tools
Special Tools/Test Equipment as Listed in FA211 Manual
#GF60455690 and BZ703 Manual #GF83322860
Microfiche Viewer

PROCEDURES:

NOTE: You will run the diagnostics/troubleshoot on-line (CML) from the system console and remote terminal and off-line (MSL/SMM) from the system console. Your instructor will specify the method(s) to use each day. Your instructor will direct you to the equipment to be used for lab.

NOTE:

The problems must be isolated to the drive or controller then to the failing component(s).

1. On-line troubleshooting. Use tables 1-1 and 1-2 in the 7155 Troubleshooting Guide to determine if the problem can be worked on in an on-line (NOS/NOSBE) environment.

NOTE:

- o You may reconfigure the system, if necessary, to work on the problem.
 - o Remember to check system error logs and obtain HPA reports (PROCEDURE 1-2 in the 7155 Troubleshooting Guide) if possible.
2. Off-line troubleshooting. If the operating system cannot be used to troubleshoot the problem, use PROCEDURE 1-8C (MSL) or PROCEDURE 1-8D (SMM) in the 7155 Troubleshooting Guide, to load the off-line diagnostic system.
 3. Troubleshooting 885 drive. Use all diagnostic error messages and any necessary tables and procedures in section 3, 885 Drive Isolation/Correction in the 7155 Troubleshooting Guide to isolate and repair the problem then verify the fix.
 4. Troubleshooting 7155 Controller. Use all diagnostic error messages and any necessary tables and procedures in section 2, controller isolation/correction, in the 7155 Troubleshooting Guide to isolate and repair the problem then verify the fix.

NOTE:

- o Analyze general and detailed status words.
- o Use the BZ703 and FA211 Manuals to identify failing circuits.

DIRECTIONS:

After your instructor places the problem in the subsystem

- o Obtain and analyze any available error reports.
- o Determine best method to troubleshoot problem (on-line/off-line).
- o Load and run the diagnostics in a sequence to isolate the problem to the drive or controller.
- o Isolate to the failing module or component using the necessary maintenance tools.
- o Repair the problem and verify the repair.
- o Fill out a problem worksheet for each problem you troubleshoot. Problem worksheets begin on SLM-21.

Failing Diagnostics. List the diagnostic(s) and module that failed.

Significant Error Indications. List any diagnostic error messages and any equipment fault indicators or conditions or LED displays.

Suspected Failing Logic. List failing logic as indicated by the diagnostic message or troubleshooting guide. (Indicate controller or drive problem).

Bad Module. Record the location and type of logic module or component involved.

Comments. Record problems and the actual failing logic. Review them with your instructor and laboratory partner.

Instructor Checkpoint. Always ask your instructor to initial your problem worksheet.

NOTE:

Insure the equipment is operational at the end of lab.

CYBER FMD SERIAL APPLICATION
STUDENT LAB MANUAL

DAY 3

TOPICS: Diagnostics, Troubleshooting

OBJECTIVES: 1, 3, 5, 7, 10, 11, 12

REFERENCE MATERIALS:

7155 Reference Manual #60455860
FA211 Hardware Maint. Manual #GF60455690
BZ703/BZ708 Hardware Ref. Manual #83322880
BZ703 Hardware Maint. Manual Vol. 1 #GF83322860
BZ703 Hardware Maint. Manual Vol. 2 #GF83322870
7155 Troubleshooting Guide #60456010
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EQUIPMENT/TOOLS:

6000, or CYBER 7X, or CYBER 17X Computer with Serial
FMD Subsystem
Oscilloscope
Standard Site Tools
Special Tools/Test Equipment as Listed in FA211 Manual
#GF60455690 and BZ703 Manual #GF83322860
Microfiche Viewer

PROCEDURES:

NOTE: You will run the diagnostics/troubleshoot on-line (CML) from the system console and remote terminal and off-line (MSL/SMM) from the system console. Your instructor will specify the method(s) to use each day. Your instructor will direct you to the equipment to be used for lab.

NOTE:

The problems must be isolated to the drive or controller, then to the failing component(s).

1. On-line troubleshooting. Use tables 1-1 and 1-2 in the 7155 Troubleshooting Guide to determine if the problem can be worked on in an on-line (NOS/NOSBE) environment.

NOTE:

- o You may reconfigure the system, if necessary, to work on the problem.
 - o Remember to check system error logs and obtain HPA reports (PROCEDURE 1-2 in the 7155 Troubleshooting Guide) if possible.
2. Off-line troubleshooting. If the operating system cannot be used to troubleshoot the problem, use PROCEDURE 1-8C (MSL) or PROCEDURE 1-8D (SMM) in the 7155 Troubleshooting Guide, to load the off-line diagnostic system.
 3. Troubleshooting 885 drive. Use all diagnostic error messages and any necessary tables and procedures in section 3, 885 Drive Isolation/Correction in the 7155 Troubleshooting Guide to isolate and repair the problem then verify the fix.
 4. Troubleshooting 7155 Controller. Use all diagnostic error messages and any necessary tables and procedures in section 2, controller isolation/correction, in the 7155 Troubleshooting Guide to isolate and repair the problem then verify the fix.

NOTE:

- o Analyze general and detailed status words.
- o Use the BZ703 and FA211 Manuals to identify failing circuits.

DIRECTIONS:

After your instructor places the problem in the subsystem

- o Obtain and analyze any available error reports.
- o Determine best method to troubleshoot problem (on-line/off-line).
- o Load and run the diagnostics in a sequence to isolate the problem to the drive or controller.
- o Isolate to the failing module or component using the necessary maintenance tools.
- o Repair the problem and verify the repair.
- o Fill out a problem worksheet for each problem you troubleshoot. Problem worksheets begin on SLM-21.

Failing Diagnostics. List the diagnostic(s) and module that failed.

Significant Error Indications. List any diagnostic error messages and any equipment fault indicators or conditions or LED displays.

Suspected Failing Logic. List failing logic as indicated by the diagnostic message or troubleshooting guide. (Indicate controller or drive problem).

Bad Module. Record the location and type of logic module or component involved.

Comments. Record problems and the actual failing logic. Review them with your instructor and laboratory partner.

Instructor Checkpoint. Always ask your instructor to initial your problem worksheet.

NOTE:

Insure the equipment is operational at the end of lab.

NOTES:

PC0004
PRG/4449B/39

SLM-18

NOTES:

NOTES:

PC0004
PRG/4449B/41

SLM-20

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 1 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-21

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 2 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-22

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 3 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-23

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 4 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 5 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 6 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 7 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 8.WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 9 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 10 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-30

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 11 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 12 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 13 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 14 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 15 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 16 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 17 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-37

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 18 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 19 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 20 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-40

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 21 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-41

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 22 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-42

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 23 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-43

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 24 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 25 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-45

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 26 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-46

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 27 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 28 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-48

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 29 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 30 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-50

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 31 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 32 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 33 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 34 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-54

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 35 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 36 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-56

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 37 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 38 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-58

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 39 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 40 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-60

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 41 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-61

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 42 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-62

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 43 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-63

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 44 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-64

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 45 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-65

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 46 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-66

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 47 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 48 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-68

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 49 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

CYBER Fixed Module Drive
Problem Worksheet

PROBLEM 50 WORKSHEET

- a. Failing Diagnostics
- b. Significant Error Indications
- c. Suspected Failing Logic
- d. Bad Module
- e. Comments
- f. Instructor Checkpoint

SLM-70

COMMENT SHEET

MANUAL TITLE CYBER FMD SERIAL APPLICATION

PUBLICATION NO. 75446693 REVISION A Prod. No. PC0004

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BUSINESS
ADDRESS: _____

COMMENTS:

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